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Research discoveries are the foundation of our dental education. But that was not always the case. When the first dental school was established in 1840, dentistry was considered to be quite apart from medicine. Strength and dexterity were what was necessary to become a good dentist, not a general understanding of biology, the human body and how it works.

It was thought that oral health had little to do with general health. The mouth and all that resided therein were isolated from the rest of the body. The fact that a human could survive without any dentition was thought to prove the notion that teeth were handy but not necessary for the body to survive. In early American history, restoration of teeth fell to silversmiths and other tradesmen proficient in the combination of their digital dexterity and artistry.

By the 19th century, there was a proposal by some progressive educators and dental advocates to integrate dental and medical education. When that idea was proposed, it led to “the great rebuff.” Medicine deemed dentistry not a worthy specialty of medicine. Stomatology was unimportant and not an appropriate or necessary body of information for those studying medicine. This estrangement led to the establishment of schools of dentistry, institutions separate from medicine.

Dr. William J. Gies’s 1926 report Dental Education in the United States and Canada transformed dental education. He advocated for at least two years of university-level education as a requisite for incoming dental students. He described and lamented the schism that divided dental and medical schools. Dr. Gies wanted dental schools to enjoy the same level of recognition and support from universities as medical schools. His report makes for very interesting reading today. Many of the same drivers are still at work and his prescient warnings are thought-provoking and relevant today, 91 years after publication.

Dr. Gies’ report was the product of five years of personal research including two in-person visits to each of the existing dental schools in the United States and Canada. The first school of dentistry, the University of Maryland’s School of Dentistry, had been in existence for 86 years at the time of the report’s publication. The Gies report was a watershed in the history of dental education and provided guidelines for modern dental education.

Dr. Gies described the nature of research and its role in dental education at the time.

“Most of the research in dentistry has been conducted under commercial influences and relatively little has been attempted in dental schools or universities. Large sums have been expended on the invention and improvement of valuable dental goods, but practically no funds have been forthcoming for the promotion of research relating to the welfare of the teeth and mouth and to the health of the whole person as it is affected by oral conditions. Compared with the activity in original investigation in medical schools, research in dental schools is weak and uninspired. The secrets of the means for the prevention of dental and oral abnormalities may remain hidden indefinitely unless dental schools actively institute a search for them and find the minds and obtain the resources with which to promote adequate investigation. Many of the universities have been indifferent to this situation because dental faculties, interested chiefly in private practice, have failed to show the urgency of biological research for the promotion of dentistry.”

Dr. Gies went on to describe why university-based research is so important. He underscored that not only is it difficult to produce good research, but we must be able to recognize good research from bad.

“He [Dr. Gies] underscored that not only is it difficult to produce good research, but we must be able to recognize good research from bad.
patient repetitions, rigorous skepticism, intellectual integrity and independence, and judicial discrimination and decision, research becomes a make-believe of unwarranted inferences and unsupported speculations, however attractively or persuasively it may be dressed up. The prevailing uncritical acceptance of the pretensions of such research in dentistry will come to an end when dentists receive the kind of education that will fortify their minds against it, and that will enable them to form a reasonably sound judgment as to the quality of any published research on a dental subject.”

In dental school, we heard the name of G.V. Black quite often. He was credited with having provided the first nomenclature and catalog of dental hand instruments. We learned surgical and restorative skills passed down from him. He was the father of dentistry in America.

However, Dr. Gies has had more impact on our profession and dental education. The integration of medicine and dentistry is closer to becoming a reality today in education and in public perception than ever before. We strive to become better practitioners not only in our restorative technical proficiency but also in our understanding of the changing world of oral health and disease management. Dr. Gies emphasized that university-based research is critical to the future of dentistry and oral health, and he clarified that minds well trained to critically understand research will become minds better able to turn discovery into health in the future.

REFERENCES

The Journal welcomes letters
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“Why do I feel so uncoordinated about dental benefits?”
Misunderstanding Generational Differences

David W. Chambers, EdM, MBA, PhD

Before we had fake news, there was an urban legend that beginning dentists were unethical because of their heavy educational debt. There are no published studies supporting this claim. The average age for disciplined physician and dentist licenses in California is in the mid-50s. Cheating in dental schools has been about 70 percent recently, compared with the low 90 percent range in the 1980s. A research paper published in this journal in 2002 found no connection between debt and “nontraditional treatment plans.” Educational debt plus interest have risen by an average of $5,800 each year since 1985. But for most of this period total debt was a constant three-quarters of general practitioners’ net income for a single year. What changed in about 2005 when the rumors linking educational debt and unethical practice began to surface was that established dentists’ earnings went flat.

The times change for everyone. All of dentistry is becoming more commercial, privileging ICD codes over care, membership in organized dentistry is declining at 1 percent per year while fictitious business names proliferate, dentists say they create smiles rather than health, and more and more they look to vendors rather than colleagues for values. Ethics is too often defined as coming close enough to minimal compliance with the law. The personalities of generations are a result of how they react to the continual changes in society.

Today, the young ones are characterized as “selfish,” “now oriented,” “FOMO — fear of missing out,” “team oriented” and participating in the social cause de jour. I recall when baby boomers were labeled “entitled,” “smug,” “driven” and “expecting to live (practice and retain control) forever.” Often the older generation is locked into fighting the wars of 30 years ago, while the new generation sees emerging challenges.

Generation X grew up playing The Legend of Zelda. It is grounded in the classic myth of a solo hero saving the princess in distress by overcoming obstacles to acquire “powers” and move to new levels. Baby boomer parents approved of the mission. After all, they were moving through the chairs in organized dentistry and building secure futures “for their families.” What was objectionable was the “virtual” nature of Gen-Xers’ participation. Success was possible without the blessing of authority.

Millennials cut their teeth on SimCity. This is a massively multiplayer online game, where a huge virtual community interacts in real time to build worlds that are individually satisfying. The goal is personally defined, the rules are few and outcomes are determined by what one does in the context of what others are doing. Unenforced rules are just PR slogans. Communities emerge based on local interactions and they change shape quickly. That sure puts a stick in the spokes of large organizations’ top-down strategic planning. ■
New ‘Bioactive’ Glass Repairs Decayed Teeth

Most people regard glass as being chemically stable and inert. However, a group at Queen Mary University of London (QMUL) has now developed a very fast dissolving “bioactive” glass that they are putting in toothpaste to repair decayed teeth.

The team has already developed versions of bioactive glass that release fluoride, forming a chemical that mimics tooth and bone mineral, and have put these to use in toothpaste and dental fillings that replace the lost mineral in decayed teeth.

Now, the team’s research published in the Journal of Physical Chemistry B has shown the potential of a glass that uses chlorine instead of fluorine. The chlorine atom and ions are much bigger, which enables them to incorporate much more of it into the glass.

The team’s spin-off company has also launched the first product based on these chloride-containing glasses — a remineralizing toothpaste designed for people who don’t want to use a fluoride-containing toothpaste and for areas of the world where the water is naturally fluoridated.

“This toothpaste is unique because it can put back the mineral lost from your teeth after consumption of an acidic drink, but without the use of fluoride,” said Robert Hill, BSc, McC, PhD, from QMUL’s Institute of Dentistry.

“This isn’t just for people who have bad teeth; everyone can potentially benefit from using this new toothpaste.”

Learn more about this research in the Journal of Physical Chemistry B (2017); pubs.acs.org/doi/abs/10.1021/acs.jpcb.7b02986.

Heat-Tempered Magnesium Alloy a Strong Choice for Implants

Titanium is the preferred material for surgical fixation procedures. However, because this super-strong metal is not absorbed by the body over time, it can cause complications like infection, fistulization, interference with skeletal growth, intolerance, thermal sensitivity and interference with imaging procedures.

A promising alternative is magnesium, a safely biodegradable metal and cofactor for many enzymes in DNA repair that also promotes bone health. But while its physical properties make it suitable for load-bearing sites, such as the temporomandibular region of the jaw, its rapid breakdown in the body sometimes results in the formation of hydrogen bubbles that can lead to serious complications.

In a unique collaboration, researchers at the New York University (NYU) Tandon School of Engineering, the NYU School of Medicine and the NYU College of Dentistry are developing and testing alloys of magnesium that are treated to improve strength and slow down the degradation process of implants, thereby avoiding the formation of these bubbles.

A study published recently in the Journal of Cranio-Maxillofacial Surgery reported on the research team’s tests of a magnesium alloy that was subjected to a process called T-5 tempering, which involved heating at 210 degrees Celsius for 48 hours.

After surgically implanting small samples of the alloy in the frontonasal region of study animals, the team examined the accumulation of the element in the lymph nodes, finding no difference between animals with no implants and the study animals. The researchers also implanted untreated — or “as-cast” — alloy, finding that both the as-cast samples and T-5 heat-treated alloys showed good biocompatibility and promoted bone growth in test animals. The T-5 alloy, however, was much more stable, with an eightfold lower degradation rate than the as-cast alloy.

“The key idea is to make an implant that can be either non-absorbable, as a permanent support, or absorbable, like sutures that go away after some time,” said Nikhil Gupta, PhD, associate professor of mechanical and aerospace engineering at NYU Tandon who was part of the research team. “The breadth of this research takes it from the lab all the way to a clinical setting.”

Read more of this study at the Journal of Cranio-Maxillofacial Surgery (2017); dx.doi.org/10.1016/j.jcms.2017.09.016.
Device for Cracking Teeth Yields Large Number of Stem Cells

Researchers at the University of Nevada, Las Vegas, have developed a new method for extracting tooth root pulp that quadruples the number of stem cells that can be harvested and replicated to treat a variety of medical conditions.

Stem cells act as transformers, recreating or morphing into a variety of cell types found within the organisms they originate from. Although they can be extracted from nearly any living tissue, one of the biggest challenges researchers face is gathering enough stem cells to work with, said James Mah, DDS, MSc, DMSc, director of UNLV’s advanced education program in orthodontics.

Dr. Mah and his team took on this challenge and in the process developed a method for extracting large numbers of stem cells from a surprisingly abundant source: third molars.

Common methods for extracting root pulp involve drilling into, removing the top of or shattering the tooth. Each method has its detractors, Dr. Mah said, all of which lead to a low stem-cell recovery rate. The researchers sought to discover a way to extract pulp in a manner that consistently produced a higher yield.

"Initially, the answer seemed simple: crack the tooth in half like a nut and remove the pulp," Dr. Mah said. But cracking teeth usually produces the same shattering effect as a hammer, thereby reducing the number of viable stem cells.

After studying fracture analysis, the team decided on a technique that scored the tooth to enable a clean break, similar to the process for custom-cut glass. With the help of the UNLV engineering department, they fabricated a device that uses a clamp to hold a tooth in position for a cutting tool to score the surface and a blade to crack it. The result is a perfectly halved tooth with immediate access to undamaged and uncontaminated root pulp.

After testing the number of viable stem cells that could be recovered from the fractured teeth, researchers realized they’d invented an extraction process that produced four times the recovery success rate for viable stem cells. “The potential application is enormous,” Dr. Mah said.

Read more about this research at unlv.edu/news.

Antibiotics for Dental Procedures Linked to Superbug Infection

Antibiotics prescribed by dentists may contribute to the growing problem of Clostridium difficile, a serious and potentially deadly infection that causes severe diarrhea, and many of those antibiotics are likely unnecessary, according to research presented in October at IDWeek 2017 in San Diego.

Taking antibiotics can put patients at risk for developing C. diff and illustrates the importance of using the medications only when needed. The Minnesota Department of Health (MDH) tracked community-associated C. diff infections in five counties in the state in patients who did not have an overnight stay in a hospital or nursing home. During the six-year period, researchers determined 15 percent of those with the infection had taken antibiotics prescribed for dental procedures.

But one-third of those patients’ medical charts included no mention of receiving dental procedure-related antibiotics, researchers determined. An earlier survey conducted by the MDH found 36 percent of dentists prescribed antibiotics in situations that are generally not recommended by the American Dental Association (ADA) and reported challenges to making appropriate antibiotic prescribing decisions, including confusion about or perceived conflicts among prescribing guidelines.

“Dentists write more than 24.5 million prescriptions for antibiotics a year. It is essential that they be included in efforts to improve antibiotic prescribing,” said Stacy Holzbauer, DVM, MPH, lead author of the study and career epidemiology field officer for the CDC and MDH, noting that better communication between dental and medical communities and improved history taking by all prescribers would help the situation.

Read more about this research at sciencedaily.com.

Clostridium difficile (Credit: James Archer/CDC)
Research Explores Periodontitis in Chédiak-Higashi Syndrome Patient

A study published recently in JDR Clinical & Translational Research (JDR CTR), a journal of the International and American Associations for Dental Research, found that when exposed to *F. nucleatum* extract, gingival fibroblast cells from patients with atypical forms of Chédiak-Higashi syndrome (CHS) expressed increased cytokine production compared to gingival fibroblast cells from classic CHS patients.

CHS is a rare genetic disorder caused by mutations in the lysosomal trafficking regulator gene (LYST), a gene that codes for a protein that helps with protein packaging and transport within cells. The study results suggest that LYST mutations may affect TLR-2 and TLR-4 expression and function and lead to a dysregulated immunoinflammatory response, which in turn influences the periodontal disease phenotype noted in CHS patients.

Researchers examined the effect of LYST mutations on expression of two members of the TLR family, TLR-2 and TLR-4, and on the immune-regulating functions of gingival fibroblasts in CHS patients. Gingival fibroblasts help form the tooth-supporting gum tissue and secrete cytokines and other molecules that facilitate cell-to-cell communication. As a standard of care, all patients with classic CHS had undergone bone marrow transplantation (BMT), while none of the atypical CHS patients received BMT.

The authors noted that in contrast to aged-matched healthy individuals, atypical CHS patients and classic CHS patients exhibited mild chronic periodontitis with no evidence of gingival ulceration, severe tooth mobility or premature exfoliation of teeth. Compared to gingival fibroblasts obtained from healthy donors, gingival fibroblasts obtained from classic CHS patients and atypical CHS patients displayed higher baseline expression of TLR-2 and lower baseline expression of TLR-4, according to the research. When treated with extract from *Fusobacterium nucleatum*, a species of bacteria associated with periodontal disease, gingival fibroblasts from both classic and atypical CHS patients failed to increase production of TLR-2 and TLR-4 compared to the untreated cells or cells from healthy patients.

This was the first study to report the periodontal findings in atypical CHS patients, said JDR CTR Editor Jocelyne Feine. Learn more about the research in JDR Clinical & Translational Research (2017); doi.org/10.1177/2380084417724117.

Microneedles Can Increase the Effectiveness of Topical Anesthesia Used in Dentistry

Researchers from Brazil and Texas have started testing a new strategy on humans to increase the effectiveness of topical anesthesia used in dentistry.

The topic was highlighted during Sao Paulo Research Foundation (FAPESP) Week held in September in Lincoln, Nebraska, and Lubbock, Texas, a special event organized to foster collaborative research between scientists in Sao Paulo and the United States.

The strategy involves a small device that contains 57 microneedles, which, when placed on the gums, cheek or other location in the mouth to be anesthetized, makes tiny holes through which anesthetic substances like lidocaine can penetrate deeper into regions of the oral mucosa. Prior to the FAPESP presentation, the method had already been tested on 10 patients in a preliminary test and was well-tolerated.

“Included among our objectives is measuring the pain caused by the 700 micrometer-length microneedles, as well as determining the effectiveness of this system in expanding the action of the topical anesthesia,” said Harvinder Gill, PhD, a professor in the department of chemical engineering at Texas Tech University and one of the researchers on the project.

The fear of the injection is one of the main reasons that cause patients to develop dental phobia and avoid dental treatments which can negatively impact the population’s oral health, according to researchers.

“That situation causes anxiety for patients and dentists alike and could compromise the treatment outcome,” Dr. Gill said.

Learn more about the Sao Paulo Foundation and the FAPESP Week research at fapesp.br/en.

Device with 57 microneedles.
(Credit: Harvinder Gill/Texas Tech University)
Researchers at Umeå University in Sweden have made a novel discovery connecting highly variant types of the caries bacterium *Streptococcus mutans* and their adhesive function to children with rampant caries and increased risk of dental caries. The results, which can lead to a better way of identifying high-risk patients and treat their caries, are published in the journal *EBioMedicine*.

In a five-year study in which saliva from a large number of children was analyzed and their dental health monitored, the researchers established that high-risk children have a more virulent variant of the caries bacterium, whose adhesive function makes it more aggressive and a better survivor.

“Caries is a lifestyle condition often caused by eating and oral hygiene habits that lead to an acidic pH in the mouth. The pH level has a damaging effect on the enamel and further promotes the growth of acid-producing bacteria such as *Streptococcus mutans*,” said Nicklas Strömberg, DDS, PhD, professor and head at the department of cariology at Umeå University and Västerbotten County Council.

This correlation is accurate for approximately four out of five individuals who have small-to-moderate risk of developing caries. However, certain high-risk children have an increased possibility of developing caries, which the results now show is because they carry particular virulent variants of the *S. mutans* bacterium that may cause caries regardless of lifestyle. The variants have unique adhesive proteins (called SpaP and Cnm) that improve the ability of the bacterium to survive the mouth’s antibacterial saliva.

One in five children in Sweden is considered a high-risk individual when it comes to developing dental caries. These high-risk children do not respond to traditional caries prevention or treatment and lifestyle variables cannot predict risk of caries.

“This new knowledge of the identified types of bacteria and how they initiate caries development could be used to improve individualized dental care. The presence of the bacteria could be used as biomarkers for early detection of high-risk patients. Also, their adhesive function could constitute new targets for treatment,” Dr. Strömberg said.

Learn more about this study in *EBioMedicine* (2017); doi: dx.doi.org/10.1016/j.ebiom.2017.09.027.
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GUEST EDITOR

Bradley S. Henson, DDS, PhD

In the November Journal we highlighted some of the innovative and exciting student research projects coming out of the California dental schools. Due to the number of excellent submissions we received from dental student researchers from across the state, we are delighted to showcase three additional student articles in this month’s issue.

The first article describes barriers patients with special health care needs face in accessing dental care. The second article illustrates expression patterns of cell line-derived neurotrophic factor (GDNF) in dental pulp stem cells of deciduous and adult teeth, suggesting a role in dental pulp regeneration. The third article evaluates the relationship between periodontitis with insulin resistance (IR) and pancreatic β-cell function.

As you read through these articles, as well as those included in the previous issue, I think you will be struck by the sheer depth and breadth of the research being conducted in California by the future stewards of our beloved profession.
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Barriers to Accessing Dental Care for Patients With Special Health Care Needs

Allyson T. Wesman, BA; Elham Nik, DDS, MS; Kathryn A. Atchison, DDS, MPH; and Eric C. Sung, DDS

ABSTRACT People with special health care needs face inequalities in access to dental care. We surveyed patients at the University of California, Los Angeles, School of Dentistry Special Patient Care clinic to determine which barriers to accessing dental care are the most difficult. We found that routine dental care is considered very important for patients with special needs, but the greatest difficulty they have in accessing dental care is finding a dentist willing to treat them.

More than one in 10 Americans is living with a disability.1 These Americans constitute a heterogeneous group of people with varying types and severity of disabilities. Data from the 2015 American Community Survey showed that 12.6 percent of people in the U.S. report a disability of some kind. Seven percent of Americans reported an ambulatory disability (difficulty walking or climbing stairs), 5.1 percent reported a cognitive disability (difficulty concentrating, remembering or making decisions), 5.6 percent reported an independent living disability (difficulty doing errands alone), 3.5 percent reported a hearing disability, 2.7 percent reported a self-care disability (difficulty dressing or bathing) and 2.3 percent reported a visual disability.1 Iezzoni et al. reported that the rate of U.S. adults with all types of disabilities increased between 1998 and 2011 and suggested that it would continue to rise in the coming years.2 The projected increase can be partially explained by rising numbers of older people, increasing populations of racial and ethnic minorities (there are higher increases in disability rates over time among nonwhite than among white populations) and higher rates of obesity. However, the authors found that adjusting for the changes in population distributions by age, race-ethnicity and body mass index does not completely account for the increase in disability rates.2 Because many people with a disability require special accommodations in receiving medical and dental care, the increasing rate of people with disabilities will lead to increased demand for special health care services in the coming years.

Unfortunately, people with special health care needs (PShCN) suffer from inequalities in access to dental care. Singhai et al. used data from the 2014 National Health Interview Survey (NHIS) to show that adults with mobility impairments were more likely to have
unmet dental needs and less likely to have annual dental visits than those without impairments. Armour et al. showed that people with disabilities were less likely than people without disabilities to have visited a dentist or dental clinic within the past year. Horner-Johnson et al. used data from the 2002–2012 Medical Expenditure Panel Survey to show that adults with disabilities had significantly elevated odds of not being able to obtain needed dental care.

Reasons for the disparity in access to dental care are varied. PSHCN face systematic barriers to oral health care such as transportation barriers and dental offices that are not physically suited for them. The cost of dental care is also a barrier for PSHCN because disability is strongly associated with low levels of education, employment and income. Other barriers PSHCN face in accessing dental care include patient anxiety and patient-doctor communication issues, among others.

Additionally, PSHCN have difficulty finding dentists willing and able to treat them. Williams et al. studied students at special education schools in Michigan and found that their most limiting barrier to care was finding a dentist willing to treat them. Limited availability of dental providers trained to serve special needs populations was listed as a barrier in the surgeon general’s 2000 report on oral health in America. Nowak et al. surveyed pediatric dentists regarding the transition of PSHCN into adult care and found that the major barrier for this transition was the availability of general dentists and specialists equipped to treat them.

The Greater Los Angeles area with its large number and variety of available dental services is an excellent place to determine whether people with PSHCN report access to care problems. California offers the fourth highest number of dentists per capita and the Los Angeles metropolitan area has the highest number of dentists of any metropolitan area in the state. In the Greater Los Angeles area, there are several one- to two-year residency programs that offer advanced training in general dentistry, and the Commission on Dental Accreditation (CODA) standards for these programs require that the curriculum include training to plan and provide multidisciplinary oral health care for PSHCN. There are four dental schools in the Greater Los Angeles area. Three of these schools have clinics devoted to special patient care and all schools are mandated by CODA to provide clinical instruction and hands-on experience with PSHCN, so all can be presumed to provide some level of care to this patient population. Thus, given the high availability of dentists, training and care centers, the purpose of this study was to understand if PSHCN in Los Angeles encounter barriers to accessing dental care and, if so, which barriers are the most difficult to overcome.

Materials and Methods

The study was reviewed and approved by the UCLA Institutional Review Board. This study took place in the UCLA School of Dentistry Special Patient Care Clinic, which offers both traditional dental care in dental clinic chairs and dental services under I.V. moderate and deep sedation and general anesthesia in the operating room with more than 4,000 visits annually from patients with special care needs. Patients were approached by the dentist on duty in the clinic on selected weekday mornings and afternoons over the course of 11 months. The patient and accompanying caregiver, if applicable, were told about the study and asked if the patient wished to participate in an anonymous survey about barriers to receiving dental care. The patients were given the opportunity to ask questions and oral consent was obtained. Surveys were collected continuously during the duration of the 11 months, with the exception of a three-month period where collection was stopped while project logistics were evaluated. A goal was established to collect 100 surveys for the study.

The intent of the study was to determine type and frequency of barriers to seeking care. The brief survey consisted of questions on common barriers to care seeking and patient characteristics. The survey was offered in English and Spanish. The questionnaire asked whether the respondent was a patient or a patient’s caregiver and instructed caregivers to respond to questions as if they were the patient. The survey collected demographic information including patient age (12–18, 19–29, 30–49, 50–64 or 65 and older) and gender (male, female or other). Patients were grouped into three categories based on the age range they indicated: young (12–18 years old), adult (19–49 years old) or older adult (50 years old and older).

Patients were asked to report the nature of their disability by selecting one or more of the following descriptions of their impairment(s): physical (e.g., cystic fibrosis, muscular dystrophy, rheumatoid arthritis), cognitive (e.g., intellectual disability, dementia, autism), hearing (e.g., deafness), visual (e.g., blind in both eyes, low vision), mental health (e.g.,
Long wait time for a dental appointment.

Fear of going to the dentist.

Did not like the patient’s dentist.

Transportation to the dental office.

Finding a dentist willing to treat the patient’s condition.

Cost/lack of dental insurance.

Unhappy with the quality of care the patient had received.

Chi-square analysis showed no significant differences between the disability category and gender, age group and language.

Finally, the questionnaire asked patients to indicate their perception of the importance of routine dental care. The VAS was anchored on the left side of the scale labeled “not important” and the right labeled “extremely important.”

Chi-square analysis was performed to determine if the disability category was independent from gender, age group, language in which the survey was completed or having had a dental problem but could not get care. Analysis of variance (ANOVA) was performed to compare the mean BSS among the three disability categories. Post hoc analysis was done using a Tukey honest s difference (HSD) test. ANOVA was also performed to compare mean importance of dental care among disability categories, gender, age group and language in which the survey was completed.

Results

One hundred surveys were collected, with 88 percent completed by caregivers with reference to the patient and 12 percent by the patients themselves. Table 1 describes the characteristics of the sample. Eighty-one percent of the surveys were completed in English and 19 percent were completed in Spanish. Forty-one percent of the respondents were classified as having a cognitive impairment, 19 percent a physical impairment and 40 percent a complex medical condition. The sample included 46 females, 23 (50 percent) with a cognitive impairment, six (13 percent) with a physical impairment and 17 (37 percent) with a complex medical condition. There were 53 males, 17 (32 percent) with a cognitive impairment, 13 (25 percent) with a
physical impairment and 23 (43 percent) with a complex medical condition. Nine percent of respondents were between the ages of 12 and 18, 70 percent were adults between the ages of 19 and 49 and 21 percent were older adults. Overall, 47 percent of respondents reported that they had had a dental problem but were unable to get care.

Chi-square analysis showed no significant differences between the disability category and gender, age group and language. The disability category was significantly associated with whether or not the patient had a dental problem but could not get care (p < 0.05) with 28 of the 47 people (60 percent) who reported they had a dental problem having a cognitive impairment, seven people (15 percent) having a physical impairment and 12 people (26 percent) having a complex medical condition. This compares to 12 (24 percent) with a cognitive impairment, 12 (24 percent) with physical impairment and 26 (52 percent) with a complex medical condition among those who did not have a dental problem (TABLE 1).

The respondents who had a dental problem but were unable to get care also provided detail about their reason for not finding care. The majority of the respondents, 25 people (54 percent), reported that the dentist was unable to handle their special medical needs, five people (11 percent) reported issues with cost or lack of insurance, two people (4 percent) reported the dentist was unwilling to treat them, one person (2 percent) reported transportation issues and 13 people (28 percent) reported other reasons (TABLE 2).

We asked the respondents to tell us how important routine dental care was to them by indicating on a VAS a mark between the left anchor of “not important” to the right side’s “extremely important.” The overall mean was 8.53 on a scale of 0 to 10 (n = 86, SD = 2.46). We found no significant differences regarding the mean importance of routine dental care by gender, age group, language or disability category, although we observed a trend (p = 0.07) for the disability category.

We examined the respondents’ perceived difficulty level presented by each of the eight possible types of difficulty (cost, transportation, finding a dentist, long wait times, travel time, quality of care, not liking the dentist and fear). Mean scores ranged from a low of 2.1 (SD = 2.9) for “did not like the dentist” to a high of 7.3 (SD = 3.4) for “difficulty finding a dentist willing to treat my condition” (TABLE 3). Barriers that presented little difficulty were “transportation to the dentist” (mean = 2.8, SD = 2.9) and “unhappy with the quality of care received” (mean = 2.3, SD = 2.9). Barriers representing more challenge to patients were “a long wait time for an appointment” (mean = 5.9, SD = 3.5) and “travel time to the dentist” (mean = 5.1, SD = 3.4). We summed the perceived difficulty level across all eight barriers to create a BSS and compared the mean difficulty ratings by disability category using ANOVA. Among all respondents, the lowest BSS was 4.3 and the highest was 66 out of a possible range of 0 to 80. The BSS analysis showed

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**TABLE 1**

<table>
<thead>
<tr>
<th>Sample Characteristics</th>
<th>Number of Respondents</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
<td><strong>Disability Category</strong></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Cognitive impairment (n = 41)</td>
</tr>
<tr>
<td>Female</td>
<td>23 (50)</td>
</tr>
<tr>
<td>Male</td>
<td>17 (32)</td>
</tr>
<tr>
<td><strong>Age Group</strong></td>
<td></td>
</tr>
<tr>
<td>Young (12–18 years)</td>
<td>5 (56)</td>
</tr>
<tr>
<td>Adult (19–49 years)</td>
<td>27 (39)</td>
</tr>
<tr>
<td>Older Adult (50+ years)</td>
<td>9 (43)</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>35 (43)</td>
</tr>
<tr>
<td>Spanish</td>
<td>6 (32)</td>
</tr>
<tr>
<td><strong>Had a dental problem but could not get care?</strong></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28 (60)</td>
</tr>
<tr>
<td>No</td>
<td>12 (24)</td>
</tr>
</tbody>
</table>

Due to rounding, not all of the totals for the variable categories are 100 percent.
† Significant at p < 0.05.
* The number of respondents in this category does not total 100, as some participants did not respond.

**TABLE 2**

<table>
<thead>
<tr>
<th>Reasons for Respondents Having Had a Dental Problem but Being Unable To Get Care (n = 46)</th>
<th>Number of Responses</th>
<th>Percent of Total</th>
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</thead>
<tbody>
<tr>
<td><strong>Reason Category</strong></td>
<td><strong>Number of Responses</strong></td>
<td><strong>Percent of Total</strong></td>
</tr>
<tr>
<td>Dentist unable to handle special medical needs</td>
<td>25</td>
<td>54%</td>
</tr>
<tr>
<td>Cost or lack of insurance</td>
<td>5</td>
<td>11%</td>
</tr>
<tr>
<td>Dentist unwilling to treat</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td>Transportation issues</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>28%</td>
</tr>
</tbody>
</table>

We examined the respondents’ perceived difficulty level presented by each of the eight possible types of difficulty (cost, transportation, finding a dentist, long wait times, travel time, quality of care, not liking the dentist and fear). Mean scores ranged from a low of 2.1 (SD = 2.9) for “did not like the dentist” to a high of 7.3 (SD = 3.4) for “difficulty finding a dentist willing to treat my condition” (TABLE 3). Barriers that presented little difficulty were “transportation to the dentist” (mean = 2.8, SD = 2.9) and “unhappy with the quality of care received” (mean = 2.3, SD = 2.9). Barriers representing more challenge to patients were “a long wait time for an appointment” (mean = 5.9, SD = 3.5) and “travel time to the dentist” (mean = 5.1, SD = 3.4). We summed the perceived difficulty level across all eight barriers to create a BSS and compared the mean difficulty ratings by disability category using ANOVA. Among all respondents, the lowest BSS was 4.3 and the highest was 66 out of a possible range of 0 to 80. The BSS analysis showed
that people with a cognitive impairment had the highest mean BSS score (mean summed score of 40.4 compared to 28.8 for physical impairment and 29.6 for complex medical condition, p < 0.05). A post hoc Tukey test showed that the mean BSS for the cognitive impairment group differed significantly from the means of each of the physical impairment and complex medical condition groups (p < 0.05). There was no significant difference in BSS between the physical and complex groups.

We asked respondents to tell us how long it takes to get to the dental office, and only 11 percent reported a travel time of less than 30 minutes (FIGURE). Two-thirds of the respondents reported that it takes them more than one hour to reach the dental office, with 30 percent reporting travel times of more than two hours. The vast majority (83 percent) of respondents reported that they were driven to dental appointments by a friend or family member, with 8 percent relying on medical transportation, 4 percent driving themselves, 3 percent using public transportation and 2 percent reporting other methods of transportation.

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>Mean Ratings Regarding Difficulty of Barriers to Care by Category of Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrier</td>
<td>Cognitive impairment</td>
</tr>
<tr>
<td>Cost/lack of dental insurance</td>
<td>3.8 n = 33, SD = 3.5</td>
</tr>
<tr>
<td>Transportation to the dental office</td>
<td>2.6 n = 34, SD = 2.8</td>
</tr>
<tr>
<td>Finding a dentist willing to treat the patient’s condition</td>
<td>8.4 n = 34, SD = 2.5</td>
</tr>
<tr>
<td>Long wait time for a dental appointment</td>
<td>6.9 n = 33, SD = 2.8</td>
</tr>
<tr>
<td>Travel time (office is too far/it takes too long to get to the office)</td>
<td>5.2 n = 35, SD = 3.2</td>
</tr>
<tr>
<td>Unhappy with the quality of care the patient has received</td>
<td>3.5 n = 29, SD = 3.2</td>
</tr>
<tr>
<td>Did not like the patient’s dentist</td>
<td>3.3 n = 29, SD = 3.2</td>
</tr>
<tr>
<td>Fear of going to the dentist</td>
<td>5.3 n = 32, SD = 3.9</td>
</tr>
<tr>
<td>Barrier severity score (BSS)†</td>
<td>40.4 n = 27, SD = 13.8</td>
</tr>
</tbody>
</table>

* The number of responses in all categories does not total 100, as some participants did not rate some barriers.
† Significant at p < 0.05.
Discussion

Our study had several limitations. First, the convenience sample surveyed likely represents a sample of individuals with more extreme types and severity of disabilities among PSHCN in the Greater Los Angeles area, because the UCLA Dentistry Special Patient Care Clinic is one of the only clinics in the area that provides dental services under I.V. sedation and in an operating room setting for patients unable to be seen in a traditional dental setting. Additionally, many of the surveys were distributed during the screening process for patients at the clinic. The screening process is only required for those patients with more severe disabilities in order for the clinic to determine whether the patient should be seen in a hospital setting or in the clinic setting. This likely caused the survey sample to be overrepresented by patients with more complex medical conditions. People with the most complex medical conditions could be expected to have more difficulty finding a dentist to treat them than people with less complex conditions. This may account for the great challenge noted by the respondents in finding a dentist willing to treat them.

However, regarding temporality bias, the selection process for inclusion in the study also may confound the results regarding the barriers to finding care in that surveys were distributed both to current patients in the special needs clinic and those being screened to become a UCLA clinic patient. Therefore, the percentage of respondents reporting that finding a dentist is a difficult barrier for them may be lower, because some of the respondents to the survey found a dentist willing to treat them at UCLA, thus they may rate this barrier as less difficult than an actively seeking special needs patient who is still seeking a dentist or who gave up trying to find care. Conversely, because the study represents only PSHCN who have made a commitment to seeking dental care (and who have likely sought care at numerous other offices before coming to UCLA), the population surveyed may also be more likely to rate finding a dentist as a difficult barrier than PSHCN who are not currently seeking dental care. Future studies surveying PSHCN in environments outside the dental clinic (senior centers, homes for the disabled, etc.) may mitigate these issues.

Additionally, the sample is limited both in the age and complexity of the sample. Only 21 percent of respondents in the sample were older adults (aged 50 and older). As age increases, disability prevalence in the U.S. increases, indicating that older adults with disabilities are likely underrepresented in our sample. Many older patient populations represent patients with Alzheimer’s disease, dementia and Parkinson’s disease, all of whom are not considered sufficiently complex to require prescreening to be accepted into the Special Patient Care Clinic. On the other end of the age spectrum, only 9 percent of respondents in the sample were young (aged 12–18). This is likely due to the availability of a pediatric dental clinic in the same building where younger people with disabilities seek care. Therefore, our results represent the access barriers more relevant to the younger adult special needs patient population and those with more medically complex conditions rather than to the entire population of PSHCN.

Finally, our sample was of limited size, consisting of 100 survey responses. Additional responses would add greater weight to the results and reduce the impact of choices made for statistical modeling on the conclusions drawn.

The results of our study suggest that a main barrier to accessing dental care results from the limited availability of practitioners equipped to serve the needs of PSHCN. Among all barriers to care, respondents rated finding a dentist willing to treat them, long wait time for an appointment and travel time to the dentist as the most difficult. Indeed, when asked to explain why they were unable to get care when needed, over half of respondents said it was due to their dentist being unable to handle their special medical needs. This result is consistent with the main difficulty in accessing care faced by special needs patients elsewhere and contrasts with barriers faced by the general population. The general U.S. population reports cost as the main barrier to accessing dental care.

Unfortunately, multiple factors have led to the lack of dental providers who are willing and able to serve this population. Both the complex medical and psychological picture presented by PSHCN and economic factors may play a role. Casamassimo surveyed general dentists about treating children with special health care needs and suggested that lack of education and poor reimbursement rates from insurers may reduce the number of dentists who are able and willing to treat these patients. In particular, adult PSHCN face a unique challenge in accessing dental care. While 95 percent of pediatric
dentists treat children with special health care needs, only 10 percent of general dentists do\(^6\) and this number is almost certainly lower for adult PSHCN. Steifel noted that adults with disabilities are probably the most disadvantaged of all those with disabilities, as priority is given to the concerns of children and elderly members of this group.\(^7\)

Our study also indicates that PSHCN may have greater difficulty accessing dental care than the general population. This is consistent with prior findings.\(^3–5\) Only 14 percent of the general U.S. population reported having had a dental problem in the last year but being unable to get care,\(^5\) whereas 48 percent of patients in this study reported at one point having had a dental problem but being unable to get care.\(^5\) While recognizing that the lack of a one-year time point makes direct comparison impossible, it is clear that among people with special needs, patients with a cognitive impairment made up the majority of those who reported such a problem. This may be due to difficulties communicating with caregivers about dental pain.

This study also found that travel time to the dentist is a significant barrier for PSHCN. Travel time to the dental office was reported as the third most difficult barrier to accessing dental care, likely because of the significant average travel times patients reported (two-thirds of patients commute more than an hour to reach the dental office). The severity of this barrier to care is likely due to a number of factors. As discussed above, the limited availability of dental centers with appropriate facilities and dentists willing and able to treat PSHCN force patients to travel long distances to find appropriate care centers. Factors specific to the Greater Los Angeles area may also be at play here, with problems such as lack of reliable public transportation and heavy traffic also contributing. This finding contrasts with results of Williams et al., which showed that distance traveled and transportation posed the least difficult barriers to accessing dental care for students at special education schools in Michigan.\(^8\)

This study found that getting dental care was very important for patients of all genders, ages, languages and disability categories. While not significant, likely due to the small sample size, a trend was observed in the relation between the disability category and the importance of dental care, with patients with a complex medical condition rating the importance lower than the rating given by patients with a cognitive or physical impairment. This may be due to the fact that these patients have many other competing medical needs that may cause them to place a lower priority on routine dental care.

Finally, the study showed that patients with cognitive impairments generally rate access to dental care barriers as more difficult than those with physical impairments or complex medical conditions. Specific barriers that this group ranked as more difficult than the other groups involve interpersonal aspects of dentistry, such as being unhappy with the care they have received, not liking their dentist and fear of the dentist.

The results of this study, which took place in a region of the country with available places to treat people with special care needs, still point to the need to increase access to dental care for PSHCN by making it easier for patients to find a dentist willing to treat them. Increasing the visibility of existing dentists willing to treat PSHCN may reduce the challenge of finding those willing and capable dentists. However, expanding the availability of dentists willing and able to treat special needs patients, both in number and geography, is needed to address the top barriers to care reported, including finding a dentist willing to treat them, long wait time for appointments and travel time to the dental office. Suggestions noted in the literature could be applied here, such as increasing education about special care dentistry in dental school, including academic and clinical experiences,\(^16\) incentivizing more general dentists to treat PSHCN by increasing Medicaid payments for treatment of patients with disabilities,\(^19\) and establishing treatment and training centers specifically for PSHCN that are integrated into medical care systems in the region.\(^19\)

Recently, changes have been made to improve the difficulties in finding dental care encountered by PSHCN in California. These include Assembly Bill 1174, passed in 2014, which changed the California Dental Practice Act to allow certain allied dental professionals to determine which radiographs to perform and to place interim therapeutic restorations in public health settings based on a virtual examination by a collaborating dentist.\(^20\) This may improve access to care for some of the patients included in our study. However, given the recent nature of the changes, the outcomes were not known at the completion of the study. Additionally, the population surveyed in our study included only those PSHCN who had the means to be able to present for care in a dental clinic setting.
Conclusion

Even with the relatively high concentration of dentists with appropriate training and care centers equipped to handle their needs, PSHCN still report difficult barriers to accessing dental care in the Greater Los Angeles area. Additional attention is needed to develop ways to increase access to dental care for special needs patients.

REFERENCES


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Comparison of Expression of the GDNF Family of Neurotrophic Factors in Dental Pulp Stem Cells Within Deciduous and Adult Teeth

Kamille Mercado, DDS, and Nan Xiao, M Ortho, PhD

ABSTRACT The glial cell line-derived neurotrophic factor (GDNF) family has a role in neuron growth within the peripheral and central nervous systems. This makes it a potential therapeutic agent for neurological conditions like Parkinson’s disease and epilepsy. GDNF has also been implicated in murine odontogenesis. In permanent and deciduous human dental pulp stem cells, this study found that GDNF family members and receptors are expressed, indicating neurotrophic factors may play a role in dental pulp regeneration.

Neurotrophic factors were growth factors that can promote the survival and regeneration of the neurons. There are three major groups of neurotrophic factors: neurotrophins, including the nerve growth factor (NGF), brain derived neurotrophic factor (BDNF) and neurotrophins (NTs), the glial cell derived neurotrophic factors (GDNF) family and neurotrophins, including the nerve growth factor (NGF), brain derived neurotrophic factor (BDNF) and neurotrophins (NTs), the glial cell derived neurotrophic factors (GDNF) family and neurotropin-like cytokines, such as ciliary neurotrophic factor (CNTF) and leukemia inhibitory factor (LIF).1-3 GDNF is a member of the glial cell derived neurotrophic factor ligands (GFL), which are also considered members of the transforming growth factor-beta (TGF-beta) family.4 GDNF is the well-studied member of the GFL family.

Besides GDNF, the GFL family also includes neurturin (NRTN), artemin (ARTN) and persephin (PSPN). GFLs bind to transmembrane receptors to activate the downstream signaling pathways. GDNF preferentially binds to the GDNF family receptor α1 (GFRα1), NRTN preferentially binds GFRα2, ARTN binds GFRα3 and PSPN binds GFRα4.4,5 GDNF is the most well-studied member of the GFL family. GFRα1 mediates the activation of the RET receptor tyrosine kinase and functions through the PI3K/AKT, MEK/ERK and SRC pathways.6-7 The pathways have been shown to regulate neuron survival, growth, differentiation and migration.3 GDNF was indicated to improve neural regeneration in neurodegenerative diseases, such as Parkinson’s.8-10 It is also indicated to improve survival, proliferation

AUTHORS

Kamille Mercado, DDS, earned her bachelor of science in biology from the University of the Pacific in Stockton, Calif., and her Doctor of Dental Surgery in 2017 from the University of the Pacific, Arthur A. Dugoni School of Dentistry in San Francisco.

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Nan Xiao, M Ortho, PhD, is an assistant professor in the department of biomedical sciences at the University of the Pacific, Arthur A. Dugoni School of Dentistry in San Francisco.

Conflict of Interest Disclosure: None reported.
and migration of ureteric buds and spermatogonial SCs. One recent study by Xiao et al. indicated that GDNF is also important in mediated salivary gland regeneration following radiation damage. More recently, it was reported that Wnt signaling activation enhanced the expression of neural crest markers in human deciduous dental pulp cells. The neurotrophin receptor p75 was also found expressed in human dental pulp stem cells (DPSCs) and may denote a neurogenic subpopulation. These works suggest that neurotrophic factors can serve as potential therapeutic candidates in adult tissue regeneration in tissues other than neurons.

NGF, BDNF, GDNF, neurotrophin 3 (NT3) and neurotrophin 4/5 (NT4/5) mRNA were detected in the inner dental epithelium and dental follicle cells in developing human and rodent teeth. We hypothesized that neurotrophic factors are present in the human dental pulp stem cells and may promote dental pulp regeneration by regulating proliferation, migration and differentiation. In this study, we sought to compare the expression of the ligands of the GDNF family and their receptors in dental pulp stem cells found within deciduous (SHED) and adult (DPSC) teeth.

Materials and Methods

We cultured human DPSC cells and human SHED cells that were provided by collaborators at the University of Pennsylvania, School of Dental Medicine and the University of the Pacific, Arthur A. Dugoni School of Dentistry. DPSCs were briefly cultured in Gibco Dulbecco’s Modified Eagle medium (DMEM) (Thermo Fisher Scientific, Pittsburgh, Pa.) supplemented with 10% FBS, antibiotics and ascorbic acids.

DNA was isolated from the stem cells using TRIzol Reagent (Life Technologies, Camarillo, Calif.). Samples were homogenized in TRIzol. Chloroform was added to separate the RNA and isopropanol was used to precipitate the RNA. RNA quality was measured by 1000 spectrophotometer (NanoDrop, Thermo Fisher Scientific) in units of ng/μL. mRNA quality of SHED was 747.2 ng/μL and that of DPSC was 462.7 ng/μL. RNA was then done under UV light.

Experiments were repeated three times. Using this semiquantitative analysis, the following genes were detected at respective base pair (bp) measurements for both DPSC and SHED tooth samples (Figure): actin at 150 bp, Gdnf at 250 bp, Ntn at 200 bp, Artn at 175 bp, Pspn at 350 bp, Gfrα1 at 175 bp, Gfrα2 at 450 bp, Gfrα4 at 150 bp and Etv5 at 175 bp. Gfrα2 was present at 175 bp and RET at 800 bp for the adult tooth sample, but not for the deciduous sample. Neither the SHED nor DPSC sample showed a band for Etv4.

Results

Using this semiquantitative analysis, the following genes were detected at respective base pair (bp) measurements for both DPSC and SHED tooth samples (Figure): actin at 150 bp, Gdnf at 250 bp, Ntn at 200 bp, Artn at 175 bp, Pspn at 350 bp, Gfrα1 at 175 bp, Gfrα2 at 450 bp, Gfrα4 at 150 bp and Etv5 at 175 bp. Gfrα2 was present at 175 bp and RET at 800 bp for the adult tooth sample, but not for the deciduous sample. Neither the SHED nor DPSC sample showed a band for Etv4.

Discussion

The PCR results confirmed our hypothesis that GDNF family ligands and receptors are expressed in both adult and deciduous dental pulp stem cells. The four ligands of the GDNF family, Gdnf, Ntn, Artn and Pspn, were expressed equally in both the deciduous and the adult teeth. Their receptors, Gfrα1 and Gfrα3, were also expressed equally in both samples. Receptors Gfrα2 and Gfrα4 and co-receptor RET seem to be more highly expressed in DPSC than in SHED. On the other hand, Etv5 is more highly expressed in SHED than in DPSC. This difference in expression could indicate a change in regulation of these

<table>
<thead>
<tr>
<th>Table</th>
<th>List of Primer Pairs for PCR</th>
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<tr>
<td>Gene</td>
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<tr>
<td>Gdnf</td>
<td>TAGCTGAGGCTTCTAACCCTG</td>
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<tr>
<td>Ntn</td>
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<tr>
<td>Artn</td>
<td>TGGAGCTGAGCGACTGGACTG</td>
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<tr>
<td>Pspn</td>
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<tr>
<td>Gfrα1</td>
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<tr>
<td>Gfrα2</td>
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<tr>
<td>Gfrα3</td>
<td>AAGATGAGTGGCGGAGGAGG</td>
</tr>
<tr>
<td>Gfrα4</td>
<td>AAGATGAGTGGCGGAGGAGG</td>
</tr>
<tr>
<td>Ret</td>
<td>GATTAGAGGAGGAGGAGG</td>
</tr>
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<td>Etv4</td>
<td>GATTAGAGGAGGAGGAGG</td>
</tr>
<tr>
<td>Etv5</td>
<td>GATTAGAGGAGGAGGAGG</td>
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genes during the progression from primary to permanent dentition. The results need to be further confirmed by quantitative PCR. We conclude that all the GDNF family ligands are expressed in the SHED and DPSC, although the expression of the receptors varies in the SHED and GDNF. The finding is consistent with previous reports that neurotrophic factors are expressed in developing human and rodent teeth. More work is required to further reveal the cellular localization of the GDNF family ligands and receptors in the DPSCs, as well as to further investigate the function of GDNF family ligands in regulating DPSCs activities.

Future experiments should include a qPCR of the samples and more replications of this experiment. Further studies into the signaling mechanism of the GDNF family to elucidate more about the population of dental pulp stem cells acted on should also be done. Due to GDNF’s role in neuron growth, we ultimately hope to find a practical application for these neurotrophic factors in dental pulp regeneration, as well as in stem cell therapy and tissue regeneration in the head and neck area.

ACKNOWLEDGMENT
This work was supported by the Research Enhancement Award 03-Activity 108 from the University of the Pacific, Arthur A. Dugoni School of Dentistry.

REFERENCES

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Evaluating the Relationship of Periodontitis With Insulin Resistance and Pancreatic β-Cell Function: NHANES

Linda (Chai Yoon) Kim, BS, and George W. Taylor, DMD, MPH, DrPH

ABSTRACT We investigated the association of periodontitis with insulin resistance (IR) and pancreatic β-cell function in 1,523 and 1,654 diabetes-free U.S. adults, respectively, using 2009–2012 National Health and Nutrition Examination Survey data. Periodontal status was defined using the Centers for Disease Control and Prevention/American Academy of Periodontology criteria. Results of multivariable logistic regression analyses, after controlling for important covariates, indicated periodontitis was not significantly associated with IR or pancreatic β-cell function in this study.

Periodontitis is a chronic inflammatory disease that affects the gingival tissue and alveolar bone supporting the teeth. In 2009–2012, 46 percent of the American adult population had periodontitis, with 8.9 percent having severe periodontitis. Periodontitis elicits a prolonged systemic inflammatory response and several studies suggest it could induce or enhance the development of other systemic diseases such as diabetes mellitus and its complications as well as adversely affect glycemic control. Like periodontitis, diabetes is a prevalent chronic disease in the U.S. and in 2010 was the seventh leading cause of death. An estimated 9.3 percent of the U.S. population had diabetes in 2012, 27.8 percent of whom were undiagnosed. Of diagnosed cases of diabetes, up to 95 percent are Type 2. Approximately 1.4 million new cases are reported every year and the estimated total medical cost for diabetes is $245 billion. Epidemiological studies have shown that people with diabetes have as much as a threefold greater risk for periodontitis than individuals without diabetes and periodontitis increases the risk for poorer glycemic control, complications for diabetes and perhaps the development of diabetes itself. Moreover, systematic reviews and meta-analyses suggest periodontal therapy improves glycemic control. Thus, further understanding of the relationship between periodontitis and key factors in glucose regulation could provide additional insight into mechanisms whereby periodontitis may contribute to glucose dysregulation and ultimately to diabetes outcomes.
Since the early 1990s, periodontitis has often been considered the sixth complication of diabetes. Evidence shows diabetes increases the risk of periodontal disease and in 2003 the American Diabetes Association recognized periodontal disease to be closely associated with diabetes, being more severe and prevalent in people with diabetes than in those without diabetes and adversely affecting diabetes outcomes. Although abundant evidence supports plausible pathways in which people with diabetes could develop periodontitis, the mechanism by which periodontitis contributes to glycemic control, diabetes complications and potentially the development of diabetes needs further elucidation. Periodontitis may contribute to diabetes outcomes in a similar manner as the obesity-induced model of enhanced insulin resistance. This model asserts that the Gram-negative periodontal infections can locally and systemically increase systemic levels of pro-inflammatory cytokines, such as tumor necrosis factor-α (TNF-α), interleukin 1-beta and interleukin 6 and reactive oxygen species, consequently damaging β-cells and contributing to a state of insulin resistance. Insulin is secreted by β-cells upon oxidative metabolism of glucose, serves an anabolic function in the storage of ingested carbohydrate and fat and regulates catabolism of glucose, serves an anabolic function in β-cells and regulates catabolism of the storage of ingested carbohydrate glucose, serves an anabolic function in

Methods

Study Population
The NHANES is conducted annually by the National Center for Health Statistics (NCHS) to evaluate the health and nutritional status of adults and children in the U.S. The interview consists of demographic, socioeconomic, dietary and health-related questions and the examination includes laboratory tests and medical, dental and physiological measurements. This cross-sectional study analyzed data from NHANES 2009–2012. Included study participants were dentate U.S. adults without diabetes ≥ 30 years of age and who had complete periodontal examinations and information to determine diabetes status. Exclusion criteria for participants with diabetes were: self-report of being previously diagnosed by a physician, or if not previously diagnosed and after fasting eight to < 24 hours, having A1C ≥ 6.5, fasting plasma glucose ≥ 126 mg/dL or having a two-hour plasma glucose ≥ 200 mg/dL after a 75 gram glucose load (oral glucose tolerance test). After exclusion, 1,523 participants were included for HOMA-IR analysis and 1,654 participants included for HOMA-β analysis. The NHANES protocol was approved by the NCHS Institutional Review Board and all participants gave written informed consent. This study received exempt certification by the UCSF Institutional Review Board.

Oral Examination
All examiners for the 2009–10 oral health (OH) examination were dental hygienists registered in at least one U.S. state and all examiners for 2011–2012 OH examination were dentists licensed in at least one U.S. state. Periodontal probing depth (PD) and gingival recession were measured with a dental mirror and Hu-Friedy periodontal probe on six sites (mesial interproximal, middle and distal interproximal of both facial and lingual surfaces) per tooth, excluding third molars. An algorithm was subsequently used to calculate clinical attachment loss (CAL). The quality of data in this survey was assured by an intense training period for the dentists and hygienists who conducted the oral health examinations with calibration of OH examiners prior to the beginning of the survey, periodic monitoring and recalibration of OH examiners and periodic retraining of OH examination teams. The reference examiner visited each team three times per year to observe field operations and to replicate 20 to 25 OH examinations during each visit. An annual retraining session for each dental examiner was conducted.
by the reference examiner to reinforce existing protocols and to accommodate protocol updates as needed. All OH training, calibration and field replicate exams were conducted by the NHANES survey expert dentist. As an example of examiner reliability in NHANES 2009–2010, Kappa scores for moderate and severe periodontitis using the Centers for Disease Control and Prevention/American Academy of Periodontology (CDC/AAP) case definition guidelines were 0.70 and intraclass correlation coefficients (ICCs) for mean attachment loss were 0.80 or higher for both examiners.19 Examiner reliability results were similar for NHANES 2011–2012 (Dye B, NHANES Oral Health Reference Examiner and Trainer, oral communication, June 13, 2017).

Fasting Glucose and Insulin Assessments

Participants were asked not to eat or drink anything except water nine hours prior to their examination. Blood was drawn for laboratory tests that included fasting glucose and insulin levels. Insulin resistance was defined using the following formula: HOMA-IR = [fasting insulin (μIU/ml) X fasting glucose (mmol/ml)]/22.5. β-cell function was defined using the following formula: HOMA-β = 20 X fasting insulin (IU/ml)/[fasting glucose (mmol/ml) – 3.5].20,21

Periodontal Disease Status

The CDC/AAP case definitions were used to assess periodontal status.22 The CDC/AAP definition classifies periodontitis as none, mild, moderate and severe by combining specific attachment loss and probing pocket depth measurements for each category. Mild periodontal disease is defined as having two teeth with interproximal attachment loss ≥ 3 mm, or probing depth ≥ 4 mm at interproximal sites or having probing depth ≥ 5 mm on any site. Moderate periodontal disease is defined as having at least two teeth with interproximal attachment loss ≥ 4 mm or at least two teeth with ≥ 5 mm pocket depth at interproximal sites. Severe periodontal disease is defined as having at least two teeth with interproximal attachment loss ≥ 6 mm and at least one tooth with ≥ 5 mm of pocket depth at interproximal sites. The category of “none” for periodontitis is used for participants whose periodontal status is not mild, moderate or severe.23

The quality of data in this survey was assured by an intense training period for the dentists and hygienists who conducted the oral health examinations.

Risk Factor Assessments

To control for potential confounding in the analyses, we assessed interview responses for demographic, behavioral-risk and other relevant health-related characteristics and assessed physical examination findings and laboratory assay results. Specification of the covariates as continuous or categorical were based on recognized specifications reported in the research literature or used in practice. Demographic variables included age, gender, race/ethnicity, education and poverty-to-income ratio. Behavioral-risk variables included physical activity level in the past 30 days, cigarette smoking status, alcohol consumption and total caloric intake.24 In addition, physical examination findings provided the participant’s number of teeth, blood pressure and body mass index.25 The laboratory assays provided participant’s triglyceride levels, total cholesterol-to-HDL cholesterol ratio, hemoglobin A1C, serum cotinine (for exposure to tobacco smoke) and inflammatory biomarkers (i.e., C-reactive protein and white blood cell count).

Statistical Analyses

Survey procedures in SAS version 9.4 were used for analysis to account for the complex survey sampling design used in NHANES 2009–2012. First, we identified and operationally defined all exposure, risk factor and confounding variables listed in the preceding risk factor assessment section, as well as the outcome variables (HOMA-IR and HOMA-β). Univariable analyses and cross-tabulation procedures were conducted to determine distributions and the potential need for recoding or transformation of the outcomes and covariates.26,27 Next, bivariable analyses were performed to evaluate the relationship between periodontitis and other important covariates separately and the outcomes (HOMA-IR and HOMA-β). Next, a series of stepwise multivariable logistic regression models with increasingly more stringent criteria for selection and retention of covariates, in addition to periodontitis, were estimated to identify covariates for inclusion in final models to estimate the association between periodontitis and HOMA-IR and HOMA-β. Both HOMA-IR and HOMA-β were specified as two-level categorical outcomes using the 50th percentile as the cutpoint. The covariates selected for the final models are shown in TABLES 2 and 3.
Results

Bivariable analysis of the relationship between selected characteristics and insulin resistance and β-cell function (Table 1) estimated a significant association between HOMA-IR (the first outcome) and periodontitis, gender, BMI, FPG or A1C and metabolic syndrome. However, HOMA-β (the other outcome) was not significantly associated with periodontal disease, gender and low income status. However, HOMA-β was significantly associated with age, BMI, FPG or A1C and metabolic syndrome.

After accounting for other important covariates, the multivariable logistic regression modeling did not estimate a significant association between severe periodontitis and insulin resistance. On the other hand, gender, BMI, presence of prediabetes and metabolic syndrome were significantly associated with HOMA-IR, while age was not a significant covariate (Table 2). Similarly, severe periodontitis was not significantly associated with β-cell function after accounting for other important covariates in the model. However, the covariates BMI and metabolic syndrome (P < 0.01) were significantly associated with HOMA-β (Table 3).

### Table 1: Bivariable Analysis of Selected Characteristics With Insulin Resistance and Pancreatic Beta-Function

<table>
<thead>
<tr>
<th>Variable</th>
<th>HOMA-IR</th>
<th></th>
<th></th>
<th>HOMA-β</th>
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<th></th>
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<tr>
<td></td>
<td>Total N</td>
<td>Lower 50th% N (%</td>
<td>Upper 50th% N (%)</td>
<td>P-Value</td>
<td>Total N</td>
<td>Lower 50th% N (%)</td>
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<td>Periodontitis</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>None, mild, moderate</td>
<td>2274</td>
<td>1085 (50.4)</td>
<td>1189 (49.6)</td>
<td>&lt;0.05</td>
<td>2275</td>
<td>1083 (50.1)</td>
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<td>Severe</td>
<td>252</td>
<td>116 (43.5)</td>
<td>136 (56.5)</td>
<td></td>
<td>253</td>
<td>136 (47.3)</td>
</tr>
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<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–44</td>
<td>1031</td>
<td>507 (52.3)</td>
<td>524 (47.7)</td>
<td>0.08</td>
<td>1031</td>
<td>443 (46.0)</td>
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<td>45–64</td>
<td>1036</td>
<td>488 (49.6)</td>
<td>548 (50.4)</td>
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<td>1037</td>
<td>510 (51.8)</td>
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<td>459</td>
<td>206 (44.0)</td>
<td>253 (56.1)</td>
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<td>460</td>
<td>266 (55.5)</td>
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<td>1311</td>
<td>597 (48.8)</td>
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<td></td>
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<td>Underweight</td>
<td>27</td>
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<td>25 (96.8)</td>
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<td>Normal</td>
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<td>554 (80.5)</td>
<td>148 (19.5)</td>
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<td>701</td>
<td>530 (77.2)</td>
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<td>Overweight</td>
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<td>462 (52.3)</td>
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<td>Obese</td>
<td>863</td>
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<td>690 (78.2)</td>
<td></td>
<td>864</td>
<td>196 (23.1)</td>
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<tr>
<td>FPG or A1C</td>
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<td></td>
<td></td>
<td>&lt;0.01</td>
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<tr>
<td>Prediabetes</td>
<td>1268</td>
<td>398 (31.0)</td>
<td>870 (69.0)</td>
<td>&lt;0.01</td>
<td>1269</td>
<td>577 (46.2)</td>
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<td>1258</td>
<td>803 (65.6)</td>
<td>455 (34.4)</td>
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<td>642 (52.9)</td>
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<tr>
<td>Metabolic syndrome</td>
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<td></td>
<td></td>
<td>&lt;0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>235</td>
<td>28 (10.3)</td>
<td>207 (89.7)</td>
<td>&lt;0.01</td>
<td>235</td>
<td>54 (18.9)</td>
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<td>Absent</td>
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<td>699 (45.1)</td>
<td>991 (54.9)</td>
<td></td>
<td>1692</td>
<td>709 (44.9)</td>
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<tr>
<td>Low income</td>
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<td>&lt;0.01</td>
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<td></td>
</tr>
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<td>423 (47.6)</td>
<td>0.12</td>
<td>895</td>
<td>473 (53.0)</td>
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<tr>
<td>Yes</td>
<td>1634</td>
<td>732 (48.0)</td>
<td>902 (52.0)</td>
<td></td>
<td>1633</td>
<td>746 (47.5)</td>
</tr>
</tbody>
</table>

1. Periodontitis is specified using the CDC/AAP definition.
3. Fasting plasma glucose (FPG) or A1C classification: Normal fasting plasma glucose < 100 mg/dL and HbA1C < 5.7%. Prediabetes: Fasting plasma glucose 100 to 125 mg/dL and HbA1C 5.7–6.4%.
4. Low income level defined by total family income < $20,000/year.
Discussion

In this study, the association between periodontitis and HOMA-IR and HOMA-β in diabetes-free U.S. adults was investigated using multivariable logistic regression analyses. No significant associations were found between periodontitis and HOMA-IR or HOMA-β in the 2009–2012 NHANES data. These findings contrast with the results of two other population-based studies of the relationship between periodontitis and insulin resistance and/or β-cell function.

An analysis of NHANES data collected from 1999–2004 reported an association between periodontal infection and insulin resistance.24 White blood cell count and C-reactive protein (CRP) were found to be significant effect modifiers. The association between probing depth (PD) and HOMA-IR was statistically significant only in the presence of high white blood cell and CRP values. Unlike Demmer et al., we did not find a significant interaction between white blood cell count and periodontitis. Furthermore, NHANES 2009–2012 laboratory data for CRP were not available in the public use dataset for us to test the interaction between periodontitis and CRP. Demmer et al. comment on their findings stating chronic systemic inflammation, which occurs in periodontal disease, obesity and diabetes, could be a plausible biological mechanism.

### Table 2

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (95% CI)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/mild/moderate</td>
<td>1.0</td>
<td>0.57</td>
</tr>
<tr>
<td>Severe</td>
<td>0.9 (0.5–1.4)</td>
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</tr>
<tr>
<td>Age (years)</td>
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<td></td>
</tr>
<tr>
<td>30–44</td>
<td>1.0</td>
<td>0.51</td>
</tr>
<tr>
<td>45–64</td>
<td>0.8 (0.6–1.1)</td>
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<td>65+</td>
<td>0.9 (0.5–1.3)</td>
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<td>Smoking status</td>
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<td>Former smoker</td>
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<td>1.0</td>
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<td>Male</td>
<td>1.7 (1.1–2.7)</td>
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<td>BMI</td>
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</tr>
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<td>Normal</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>2.9 (1.9–4.3)</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>7.6 (5.4–0.8)</td>
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</tr>
<tr>
<td>FPG or A1C</td>
<td></td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Normal</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Prediabetes</td>
<td>3.7 (2.7–5.2)</td>
<td></td>
</tr>
<tr>
<td>Metabolic syndrome</td>
<td></td>
<td>&lt;.01</td>
</tr>
<tr>
<td>None</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5.1 (2.9–8.7)</td>
<td></td>
</tr>
</tbody>
</table>

1. 95 percent CI: 95 percent confidence interval.
2. Periodontitis is categorized using the CDC/AAP definition.
4. P < 0.05 comparing other to non-Hispanic white via χ² test.

### Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio (95% CI)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontitis</td>
<td></td>
<td>0.98</td>
</tr>
<tr>
<td>None/mild/moderate</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>1.0 (0.6–1.7)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
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<td>0.06</td>
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<tr>
<td>30–44</td>
<td>1.0</td>
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<tr>
<td>45–64</td>
<td>0.7 (0.5–0.9)</td>
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</tr>
<tr>
<td>65+</td>
<td>0.7 (0.4–0.9)</td>
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</tr>
<tr>
<td>Smoking status</td>
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<td>0.63</td>
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<td>Never</td>
<td>1.0</td>
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<tr>
<td>Former smoker</td>
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<td>Current smoker</td>
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<tr>
<td>Race/ethnicity</td>
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<tr>
<td>Non-Hispanic black</td>
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</tr>
<tr>
<td>Mexican American</td>
<td>1.3 (0.8–1.9)</td>
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</tr>
<tr>
<td>Other 4</td>
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<td>BMI</td>
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<tr>
<td>Normal</td>
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<tr>
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<td>Obese</td>
<td>8.4 (6.0–11.8)</td>
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<td>Metabolic syndrome</td>
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<td>&lt;.01</td>
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<tr>
<td>None</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2.7 (1.8–3.9)</td>
<td></td>
</tr>
</tbody>
</table>

1. 95 percent CI: 95 percent confidence interval.
2. Periodontitis is categorized using the CDC/AAP definition.
4. P < 0.05 comparing other to non-Hispanic white via χ² test.
that contributes to insulin resistance. They further state that in animal models, inflammatory cytokines such as tumor necrosis factor-α (TNF-α) have been shown to induce insulin resistance. The study reported by Demmer et al. and our investigation utilized data derived from U.S. population-based cross-sectional studies to estimate associations. Demmer et al. defined periodontal disease using quartiles of either PD or CAL values for the principal exposures in their analysis and secondarily, the CDC/AAP definition, specified to compare the categories of none or mild periodontitis versus moderate or versus severe periodontitis. In contrast, the current study used the CDC/AAP case definition as the exposure for periodontitis specified using all categories as a dichotomous variable (specified as none/mild/moderate versus severe). The CDC/AAP case definition involves both PD and CAL.

In the cross-sectional, population-based study of Korean adults without diabetes by Islam et al., the investigators defined periodontitis using the World Health Organization’s community periodontal index ( CPI). Periodontitis was specified as a dichotomous exposure variable using CPI code ≥ 3 (i.e., an individual having at least one site with a periodontal pocket ≥ 3 mm was classified as having periodontitis). Periodontitis was associated with decreased β-cell function and increased prevalence of impaired fasting glucose (IFG) before development of diabetes in the Korean population. In Asians, β-cell dysfunction may contribute more to the development of Type 2 diabetes than obesity-driven insulin resistance.

A potential limitation in this study is the possibility of misclassifying severe periodontitis as moderate, or moderate periodontitis as severe, thus biasing the results toward the null hypothesis, i.e., no association between periodontitis and HOMA-IR or HOMA-β. Another potential limitation of this study is the CDC/AAP definition used to classify periodontal disease status in that it did not include gingival bleeding as an indicator of active periodontal inflammation. Bleeding reflects histological, clinical and bacteriological alterations associated with periodontal inflammation and may serve as a complementary or even earlier marker of active inflammation than pocket depth and attachment loss. Some individuals with moderate periodontitis may have met the criteria for severe periodontitis if bleeding had been used as a criterion.

Another potential limitation arises from the inclusion of sites distal to second molars in the CDC/AAP definition of periodontal status. Deep probing depths and attachment loss at those sites may be the result of bone loss resulting from third molar impaction or extraction rather than periodontitis. This would be a potential source of misclassification bias for our results, especially in cases where participants only had pocketing and/or attachment loss in those sites. However, in our analyses, this potential source of bias did not have an effect because of the absence of an association between periodontitis and the two outcomes. Future studies assessing periodontitis could minimize this potential source of misclassification bias by accounting for or excluding sites distal to second molars in analyses.

One additional limitation is in the assessment of β-cell function, assessed using blood glucose and insulin levels measured nine hours after fasting. Blood glucose and insulin levels measured two hours after a glucose challenge (or even sooner after the time of the glucose challenge) were not available in the NHANES 2009–2012 data. Measuring blood glucose and insulin levels more proximal to and more frequently following a glucose challenge could more accurately assess the association between periodontitis and β-cell response and insulin resistance.

To our knowledge, the concurrent analysis of the relationship between periodontitis and the outcomes, HOMA-IR and HOMA-β, have not previously been reported for the U.S. population. A major strength of the study is the rich data available to analyze these relationships in a representative sample of the U.S. population with high-quality measurements and sufficient quantity of observations.
Conclusion
Contrary to our hypothesis, severe periodontitis was not significantly associated with insulin resistance nor with pancreatic β-cell function after adjusting for important covariates in this study. Future studies that define periodontitis by including measures for gingival bleeding as an indicator of active inflammation and assess β-cell function at times more proximal to an oral glucose tolerance test challenge may help further elucidate the relationship between periodontitis and insulin resistance and β-cell function.

REFERENCES
Specializing in selling and appraising dental practices for over 40 years!

LOS ANGELES COUNTY


LA VERNE—Est. in 1980 w/ 4 eq op in a 1, 250 sq ft. Grossing approx. $64K/mo. Net of $195K. PPO & Cash Only! Property ID #5196.


MONTEBELLO—Grossed approx. $1.1M in 2016, located in a free standing bldg w/ 5 eq ops. Established in 2002. Property ID #5168

PASADENA - Located in the heart of Pasadena w/ 60 years of goodwill. Grossed approx. $616K in 2016. Has 3 eq ops in a 1,150 sq ft suite. Property ID #5147.

RESEDA—Turn-Key GP in a single prof. bldg. with 6 eq ops. Est. in 2008. NET OF $138K. Property ID #5189.

VALENCIA — GP + 5 eq ops / 3 plmbd not eq. Est. in 1980 w/ 9 eq ops in a busy single shopping center. Grossed $1.6M in 2016. Property ID #5171.


KERN, VENTURA, & SAN LUIS OBISPO COUNTIES

CAMARILLO—GP + Real Estate. Well established practice w/3 eq ops / 1 plmbd not eq. NET OF $179K. Property ID #5150.


SAN DIEGO COUNTY

CARLSBAD—Well established GP w/ 3 eq ops and 2 plmbd not eq near residential are. Buyer’s net of $121K. Property ID #5191.


LA JOLLA—Beautiful practice with beautiful window views to the ocean. Has 3 eq ops — LH & Equip Only! Property ID #5159.

SAN DIEGO —COMING SOON!

RIVERSIDE & SAN BERNARDINO COUNTIES

BANNING—LH & Equipment only! Consists of 3 eq ops in a 925 sq ft suite. Property ID #5184.


CHINO—Real Estate Only! This is a rare opportunity to purchase a condo located in a single story strip mall. Has been a dental practice for 40 years. Property ID 5076.


HEMET GP + Condo Suite Has over 40 years of goodwill to offer. Icon in the community. Located in a single story tri-plex condon bldg. Has 4 eq ops . No Denti-cal. Net of $143K. Property ID #5152.


BUYER’S NET OF $153K. Property ID #4487.


TEMECULA—Modern designed practice w/ 3 eq ops. Projecting approx. $1.2M . Net of $444K. Property ID #5155.


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Contact Us for A Free Consultation
Keep Holidays Happy With Guidelines for Office Parties

TDIC Risk Management Staff

When planning a holiday party, one might carefully consider food, décor, entertainment and overall costs. And while choosing the party venue may be a key factor for the average host, it’s an even more essential element for practice owners to consider. Participation, employee dynamics and labor laws all come into play when planning an office party. It’s important that employers establish clear guidelines when organizing any work-related event. If care isn’t taken, practice owners can be held liable for misconduct.

In one case reported to The Dentists Insurance Company’s Risk Management Advice Line, a practice owner held a holiday party for his employees at his home. His wife, who was also the practice’s office manager, and another employee had an altercation. The owner witnessed the event but did not intervene. He was aware that his wife and the employee did not get along; however, he advised the employee to try and avoid making his wife upset.

The conflict between his wife and the employee continued when they returned to the practice; the employee resigned a few months later. The employee filed a claim alleging harassment, hostile work environment, discrimination and failure to prevent harassment. During the investigation, the dentist acknowledged his wife’s behavior and admitted to his failure for taking action as he felt he had little to no control over his wife’s management style. Other staff members confirmed witnessing events that would give rise to the allegations of a hostile work environment. Due to the problematic nature of these repeated events that transpired, the defense attorney recommended settling the case and it was settled in the high five figures.

When planning the holiday party, the practice owner assumed that the atmosphere of his home would serve as a “family” environment. In the view of the employees however, the venue was not material and their perception was that it was a work-related function.

Even if employers choose a venue other than their residences, they should still take precautions to protect themselves. Practice owners need to determine if party participation is voluntary and should notify employees in advance in writing. If the party is held during work hours, meal and rest breaks should still be observed to avoid falling out of compliance with employment laws. If the party is held after hours and attendance is mandatory, employers will be subject to overtime pay. Some employers allow employees who are attending a company party during the evening on a workday to go home early, while those who are not attending work their regular schedule.
Alcohol is another risk factor to consider, especially during the holidays. Many dentists believe that socializing with staff is a good way to get to know employees better. While learning about your staff can promote a team environment, hosting parties and providing alcohol or meeting staff for drinks after work are not recommended as employers are risking employment-related claims when professional behavior is not maintained.

Drinking may hinder employees from using their best judgment. Driving under the influence and underage drinking can also be cause for concern. Even if a party is held after work, employers can still be subject to workers’ compensation claims if an employee has an accident or becomes injured at the event.

Remarks or behavior on an employer’s part may also become informal and be construed as inappropriate. Once an employer invites most or all employees to a hosted social event or party, it can become an employment function and nothing is off the record. Eliminating alcohol can help employers ward off some of these types of risks.

Though holiday events should be celebratory and fun, maintaining professionalism among all attendees is still a must. It’s important for practice owners to remember that they are employers first, not friends of employees. Allowing an atmosphere to become too casual risks the introduction of inappropriate comments and unprofessional behavior into workplace events.

As a dentist and employer, your individual style and personality dictate the office environment in which you and your staff work. Maintaining a professional demeanor during parties can help prevent addressing any future performance issues from feeling like personal attacks.

The best action practice owners can take is to include an office policy in their employee manuals citing specific examples of unprofessional and unacceptable behavior as well as examples of respectful behavior and professional conduct. With unacceptable actions clearly defined, everyone in the office will be less likely to cross the line.

Even when employers and employees are trying to make a kind holiday gesture, the perception of it can cause unintended consequences. All holiday gifts should be appropriate in nature and remain consistent in value to avoid any perceptions of favoritism or discrimination. TDIC Risk Management analysts advise employers to treat all employees the same when it comes to gifting. By including everyone, practice owners can help maintain positive office morale.

Documenting the office’s policies and making choices that lead by example mean that everyone can relax and enjoy the holidays.

TDIC’s Risk Management Advice Line at 800.733.0633 is staffed with trained analysts who can provide guidance on workplace party protocols and other questions related to a dental practice.
4151 MARIN COUNTY GP
Well-established and respected, quality general practice located in desirable Marin County location. Office has convenient ample parking, overlooking a beautiful park-like setting adjacent to a peaceful creek. Office contains 5 ops in ~1,300 sq. ft. Gross receipts average $1.2M annually with 3 doctor days/week.

4178 SONOMA COUNTY PERIO
Seller retiring from 21 year practice with trained, seasoned staff and great location. Exceptional 2,100 sq. ft. ample office with 6 fully equipped ops. Majority of equipment purchased in 2002. 4 doctor-days & 3 hygiene days per week. Average gross receipts $1M+. Asking $677K.

4145 ROSEVILLE GP

4198 NORTH BAY PERIO
Established Periodontic practice with loyal referral sources in 1,564 square foot office with 5 fully-equipped operatories conveniently located close to Petaluma Valley Hospital. Average Gross Receipts $480K. Seller is offering the condominiumized office for sale or lease to the buyer of the practice. Asking price for practice $284K.

4191 SONOMA COUNTY ENDO
Seller retiring from 38 year endodontic practice located in attractive ground floor office (remodeled in 2011) with updated modern equipment and cabinetry. Close to several regular referral sources. Doctor sees an average of 7-8 patients per day. 5 year average Gross Receipts $700K+. Asking $447K.

4177 SAN JOSE PROSTHO
Implant, cosmetic and prosthodontic practice, established 25+ yrs in desirable West San Jose area close to several amenities and referral sources. Ideal for the restorative general dentist inspired by cosmetic and implant dentistry, or a prosthodontist. 3 fully-equipped ops in 1,100 square ft. Bright and modern treatment rooms in well established professional medical building. Lots of on-site parking, EZ freeway access. 3 yf. average GR $1.2M+ with adjusted average net of $500K+ Asking $813K.

4133 NAPA GP
Napa County GP in newly furnished, fully equipped 2 op facility with digital x-ray. 4 doctor day/week with 3 hygiene days. Average annual Gross Receipts $420K+. Seller willing to help for a smooth transition. Asking $331K.

4193 SAN BRUNO GP
Well established practice in prime, high-traffic location. 670 sq. ft. office with (3) fully-equipped operatories set up for rear delivery. Approximately 750-700 active patients with an average of 5 new patients per month. approx. 3.5 doctor days per week. 2016 gross receipts $516K+. Average adjusted overhead 56%. Seller transitioning into retirement. Asking $378K.

4190 SAN JOSE GP
Excellent location on west side of SJ in the Blossom Hill area. Easy access to Hwy 85 & 87 and light rail. Offering 17+ years of goodwill. Beautifully appointed 3 op office in 950 sq. ft. Plentiful on-site parking. 730 active patients with 1.5 days of hygiene. Average two years gross receipts $389K with adjusted net of $154K.

4150 SANTA CRUZ COUNTY GP
Seller retiring from successful 33 year general practice. Fee-for-service only practice. Fully-equipped 4 op facility in beautiful, remodeled, owner built building. Located in desirable residential and commercial neighborhood. Building also for sale.

4123 CAMPBELL GP
Seller transitioning 32 year general practice with an emphasis on Restorative and Preventative care. Well-trained and loyal staff. Approximately 32 hygiene production. 3.5 doctor days per week & 3 hygiene days per week. Average gross receipts $625K+ with adjusted average overhead of 62%. Asking $464K.

UPCOMING:
Endodontic practice on the Peninsula
General practices in Fremont, Concord, Walnut Creek, Foster City, Mid-Peninsula, San Francisco, Santa Cruz, & Solano County
North Bay Prosthodontic practice
Following are answers to questions asked recently on prescribing controlled and noncontrolled drugs.

A patient had a prescription that I wrote rejected by her pharmacy. I called the pharmacy but the pharmacist would not tell me what was wrong with my tamper-resistant prescription form. What could have happened?

Two things may have occurred. One is that the form may have been printed by a printer not approved by the state of California. Many prescription-form vendors advertise the availability of tamper-resistant forms, but only forms printed by state-approved printers (oag.ca.gov/security-printers/approved-list) are recognized by California pharmacies.

The second thing that may have occurred is that the forms may have been outdated and do not have all the required elements. Tamper-resistant forms printed in 2012 or earlier may not have all the required elements because the law changed effective July 1, 2012. Per Health & Safety Code Section 11162.1, the following items must be preprinted on each form:

- Description of the security features.
- Prescriber’s name and address.
- Category of licensure and license number.
- Federal controlled substance registration number (DEA number).
- Six quantity check-off boxes so that the prescriber may indicate the quantity by checking the applicable box where the following quantities shall appear:
  - 1–24
  - 25–49
  - 50–74
  - 75–100
  - 101–150
  - 151 and over
- In conjunction with the quantity boxes, a place to designate the units referenced in the quantity boxes when the drug is not in tablet or capsule form.
- The statement “Prescription is void if the number of drugs prescribed is not noted” (on the bottom of the form).
- Check boxes for the prescriber to indicate the number of refills ordered.
- A place to indicate the prescription’s date of origin.
- A check box indicating the prescriber’s order not to substitute.
- An identifying number assigned to the approved security printer by the Department of Justice.
- A check box by the name of each prescriber when the form lists multiple prescribers. (The prescriber signing the form must check the box next to his or her name.)

Note that each batch of ordered forms will have the lot number printed on the form and each form within that batch will be numbered sequentially beginning with the numeral one.

The practice telephone number and individual National Provider Identifier (NPI) number, while not required to be preprinted on the form, are useful for the pharmacy to have preprinted.

My employer is requiring I obtain a DEA number and I do not want to do so because I do not prescribe controlled substances. My employer believes it is required in order to prescribe any drug.

DEA registration is required to prescribe controlled substances, but it is...
not required to prescribe noncontrolled drugs such as antibiotics or fluoride. Some states, but not California, require a separate registration for prescribers.

We have a large practice with several dentists working at two or more of our locations. It would be nice not to have to print individual prescription forms for each dentist at each location. Is there any issue with putting all the dentists’ names and practice locations, with check boxes, on one form?

What will you do when one dentist leaves the practice—order new forms? A dentist who leaves the practice will want to ensure prescription forms with his or her information are destroyed to prevent attempts by others to fraudulently obtain drugs. Although it is allowed to have more than one prescriber and more than one location on a prescription form, think carefully about what you will do when one dentist leaves the practice.

I used to order compound profound gel from a pharmacy that is now closed. How can I find another pharmacy that offers this compound drug?

Pharmacies, compounding pharmacies and wholesale drug suppliers — within and outside California — must be registered with the state board of pharmacy if they conduct business within the state. You can do an online search for the compound drug, then verify that the pharmacy providing the drug is registered in California. To verify that a compounding pharmacy has a California license, start at pharmacy.ca.gov/about/verify_lic.shtml, then search under “Sterile Compounding” for in-state pharmacies or “Non-Resident Compounding” for out-of-state pharmacies.

Regulatory Compliance appears monthly and features resources about laws that impact dental practices. Visit cda.org/practicesupport for more than 600 practice support resources, including practice management, employment practices, dental benefits plans and regulatory compliance.
6133 SAN RAMON'S BISHOP RANCH  Beautiful 4-op, computerized and digital office. Located in the Bishop Ranch Medical Center. Bring Business Plan. Great addition to existing network.

6132 NORTH FREMONT AREA  $420,000+ invested here. Very high end for great patient experience. 3-ops equipped with 4th available, Panorex, completely networked and digital. $600,000+ in revenues.


6129 PROSTHODONTIC PRACTICE – SAN MATEO  2016 collected $775,000 on 3.5 day week. Beautiful 5-op office. Excellent candidate for acquisition by nearby practice. Seller shall work back to assist in orderly transition. Acquire here or move into nearby practice. Choice is yours.


6127 SAN RAFAEL'S NORTHGATE  Collected $210,000 in 2016 on part-time schedule. Available Profits of $106,000.

6125 OAKLAND AREA  Collections average $735,000 per year. High income zip code with well employed Millennials next door. 10+ new patients per month. Digital and paperless.

6124 SAN RAMON  100% Out-of-Network. 5-Ops. 6-days of Hygiene. $700,000 per year performer.

6122 SANTA CLARA - STARBUCKS "LIKE" LOCATION!  Best exposure in beautiful strip center. Office just remodeled. $600,000+ in high end for great patient experience. 3-ops equipped, Panorex, completely networked and digital. $600,000+ in revenues.

6121 NAPA VALLEY FAMILY PRACTICE  Highly respected community asset. Collections average $1.28 Million per year. Beautiful facility. Condo optional purchase.

6120 OAKLAND'S PIEDMONT AREA  Highly coveted area. Right off Highway 13. 3-ops. Digital Hygiene. 4-Ops with 5th available. 2016 collected $800,000+.

6119 NORTH BAY ORTHO  Desirable family community. Best technology, cone beam and panoramic. Owner works part-time. Revenue streams averaged $775,000/year in past. Strong profits. Does no marketing to local Dental Community.

6118 SAN FRANCISCO'S EAST BAY  Forty percent partnership in well positioned and branded practice. 2016 collected $2.53 Million. 2017 trending $3.2 Million in collections. Full complement of specialties. 6-month Trial Agreement wherein interested Candidate shall see ability to make $350,000+ per year.

6117 MODESTO - TURLOCK AREA  2016 collected $650,000 with great Profits. PPO provider in the competition.

6114 LINCOLN  $1.1+ Million performer. Profits tracking $425,000+. Beautiful and extensive facility leases for $1.60 sq.ft. PPO Practice.

ENDODONTIC PRACTICE  Central California Beach City. Established 20+ years. Grosses $1,200,000 & Nets $800,000.

ANAHEIM  Korean clientele. Part-time grossing $200,000+. 3-Ops, some ortho. Rent $2,300. Close to Harbor Freeway exit. Full Price $110,000.

ANTELOPE VALLEY / SANTA CLARITA VALLEY  Two separate Million Dollar Opportunities. Absentee Owners.

BELLFLOWER  Female owned Hispanic practice. Part-time. Low overhead opportunity.


EAST LOS ANGELES  Part time senior female grossing $20-to-$35,000/month. Established many years, Low overhead. Full time will do $600,000.

INLAND EMPIRE  Long time Union Patient Practice. Part-time Seller works 3 days. Grossing $650,000. Patients are available to go to 6-days. Great union benefits.

INLAND EMPIRE  Shopping center. Great Lease. 3-ops in 1,650 sq.ft. Absentee Owner. Grosses $30,000/month. Working Seller used to do $50,000/month. 20-to-30 new patients/month. Full Price $285,000.

INTERSTATE 405 & ARTESIA  Established many years. 2-Ops. Full Price $150,000.

IRVINE LOCATION  6-Ops, Beautiful state-of-the-art office. Full Price $150,000.

IRVINE  Professional Building. Chinese clientele. Grosses $500,000-to-600,000 6-Ops in 2,000 sq.ft. Rent only $5,000. Seller here 2 days per week.

IRVINE  Lady DDS Grossing $1.2 Million. Professional Building. 5-Ops. Only Dentist in building. Full Price $885,000.

LA PUENTE  Established 20-years. Small shopping center. 3-Ops. Full Price $150,000.

LAKE ELSINORE  Great second location for DDS working part-time. 6-Ops. Rent $2,700. Grossing $500,000-to-$600,000. Some HMO.

NEVADA DENTURE PRACTICE  Add Implants. Will do $2 Million. 4,000 sq.ft. rents for $4,000. Full Price $850,000.

NEWPORT BEACH'S FASHION ISLAND  Grossing $400,000-to-$500,000.

ORANGE COUNTY BEACH CITY  Location, location! Previous Gross One Million. Facility only. 6-Ops with computerized monitors, TV's and Dentrix. Full Price $150,000.


PEDO  Chinese / Hispanic. Grosses $450,000. 4-Ops, low rent. Digitized office. Lots of options to grow to Million Dollar practice.

REDLANDS  Great Location. Rent $1,100/month. 3-Ops. Nice patient base. Full Price $150,000.

WEST LOS ANGELES  High Identity Location. 3-Ops. Room to grow. Free parking. Grossing $450,000. Full Price $500,000.
A look into the latest dental and general technology on the market

Study Says Using Smile Emojis in Work Emails Could Create Perception of Incompetence

Many use smile emojis when they send emails as a way to show warmth and understanding. A new study conducted by researchers at Ben-Gurion University of the Negev (BGU), reveals that including smile emojis in work emails may do the opposite. Specifically, the study found that the emojis “decrease perceptions of competence.” A total of 549 people from 29 different countries participated in the study and in one of the experiments, “the smileys in an email had no effect on the perception of warmth, and in fact had a negative effect on the perception of competence.”

Ella Glikson is a postdoctorate fellow at the BGU department of management, Guilford Glazer faculty of business and management.

“People tend to assume that a smiley is a virtual smile, but the findings of this study show that in the case of the workplace, at least as far as initial ‘encounters’ are concerned, this is incorrect,” Glikson said.

For more information, visit eurekalert.org.

— Blake Ellington, Tech Trends editor

Majority of Americans Credit Technology for Improving Lives

A large chunk of Americans feel that technology is responsible for improving their lives the most out of anything else in the last 50 years. According to a new survey by the Pew Research Center, 42 percent of Americans credit technology when asked what has enhanced their lives the most. Medicine and health come in second at 14 percent and civil and equal rights come in third at 10 percent. The study was conducted between May and June. For more information, visit pewresearch.org.

— Blake Ellington, Tech Trends editor

Apple Watch Series 3 (Apple, Starting at $329)

Apple has released the latest in its line of smartwatches, dubbed “Series 3,” with new features that improve the user experience. Like previous models, Apple Watch has many band and case options with pricing that varies based on these customization preferences. The newest distinctive capability of this series is the option for added cellular service, which brings data and voice without the need for a paired iPhone to be connected.

For all models in this series, a faster dual-core processor and an added Apple wireless chip provide a more responsive experience with the ability to connect to Wi-Fi networks and Bluetooth devices more efficiently, resulting in the same all-day battery life even with the new features. Activity and fitness tracking is improved through the addition of a barometric altimeter, which detects flights climbed and elevation gain during workouts. Siri, the personal digital assistant, now provides audio feedback during requests through the built-in speaker. While charging is normally done through the included magnetic charging cable, this series also supports the upcoming AirPower mat, an Apple-designed device that can wirelessly charge the newest iPhone, Apple Watch and AirPods (with a new optional case) simultaneously on a single surface.

For many users, the ability to use their Apple Watch without a paired iPhone for short periods of time is now possible. Only for models with the cellular feature, a built-in eSIM allows major cellular LTE service providers in the U.S. to access data and voice on Apple Watch using the same phone line as its paired iPhone for a small additional monthly charge. Additionally, users who subscribe to Apple Music can stream radio stations, podcasts and music playlists directly to Apple Watch over a cellular connection. This freedom, however, significantly affects battery life, which ranges from one to four hours depending on use and cellular coverage. While not designed to be completely independent all day from its paired iPhone, the cellular capability does provide quick convenience to Apple Watch users when needed for common tasks.

Apple Watch Series 3 has many features sure to entice new users and those upgrading from the original model. The addition of cellular service is an important feature to have, but this series provides only modest updates over the previous model.

— Hubert Chan, DDS
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BAY AREA

**AC-566 SAN FRANCISCO:** Spectacular views of Washington Square. 3 ops +2 add'l, 1400sf $170k

**AC-624 SAN FRANCISCO:** Wonderful patients, solid income in great stand-alone bldg $475k

**AC-649 SAN FRANCISCO** Facility: Richmond District, 3 ops+1 add'l, Equipment less than 5yrs old $120k

**AG-562 SAN FRANCISCO:** Strategically located. Huge potential. 2 ops + 1 add'l, 600sf $175k

**AG-645 SAN FRANCISCO:** Low Overhead, compact practice ready for expansion or relocation. Retail/Commercial area. 2nd Floor $99k

**AG-669 SAN FRANCISCO:** RARE opportunity in the heart of the city 2 ops LOW OVERHEAD! $88k

**AN-513 REDWOOD CITY:** Practice of your dreams! 900sf w/ 4 ops + 2 add'l! $350k

**AN-686 SAN FRANCISCO:** Office designed w/ patient flow & maximum office efficiency. 1000sf w/ 4 ops $825k

**AN-712 SAN FRANCISCO:** Easy accessibility, exceptional visibility, free parking & extremely low rent! 1000sf w/ 2 ops + 2 addl! $89.5k

**AN-752 SAN FRANCISCO** Facility: 3 months Free Rent! Opportunities like this one are few and far between! 1007sf w/ 4ops. $125k

**BC-681 WALNUT CREEK:** Remodeled office located in semi-rural community, 1000sf w/ 4 ops $432k

**BC-682 CONCORD:** Located in desirable, bustling community w/ seasonal, caring staff. 836sf w/ 3 ops $224k

**BC-710 WALNUT CREEK:** Desirable location in stand-alone, single-story bldg. 1313sf w/ 3 ops $150k / RE $850k

**BC-741 DANVILLE (FACILITY):** Move in Ready facility to build the practice of your dreams! ~ 1600sf w/ 3 fully equipped ops $195k

**BC-758 PLEASANT HILL (FACILITY):** Gorgeous décor & perfect location! 768 sf w/ 2 ops $50k

**BG-724 RICHMOND:** Spacious office w/ enormous growth potential! 2000sf w/ 4 ops Practice $138k / Real Estate $700k

**BG-731 LAFAYETTE:** Well-educated, health conscious patient base. 1,000 sf w/ 3 ops 35+ years goodwill $229k

BAY AREA CONTINUED

**BN-504 RICHMOND:** Established Practice & Real Estate! 1450sf w/ 2 ops + 2 addl! $100k / RE $700k

**BG-734 ANTIoch:** The perfect place to work, live and play! Located in desirable professional neighborhood. 1,323 sf w/ 4 ops. $315k

**BG-765 FREMONT:** This quality practice is the true definition of a “Family Practice”. 1000sf w/ 2 ops. $295k

**CC-661 SAN RAFAEL:** Starter practice in beautiful location w/ like-new equipment. 3 ops, 900sf $190k

**CC-719 SAN RAFAEL:** Panoramic views of Mt. Tamalpais from each operatory window, 4 ops, 3,050sf w/ 3 ops $1.05M

**CC-832 HOLLISTER:** Delicious practice $800k & $400k for the Real Estate

**DC-650 SACRAMENTO:** Desirable location. 5 npts/mo, 3 ops in 900sf $375k

**DC-692 DUBLIN Facility:** Modern digital office designed w/ Cone Beam or $165k w/o Cone Beam $425k

**DG-635 CASTRO VALLEY:** Loyal, stable, multi-generational patient base. FFS. 1460sf w/ 4 ops $315k

**DG-650 CASTRO VALLEY:** Excellent location & stellar reputation! Solo Group Practice $650k

**DG-738 WATSONVILLE:** Beautifully remodeled, 2,600sf office, visibly located in attractive shopping complex $480k

**DG-635 CASTRO VALLEY:** Excellent location & stellar reputation! Solo Group Practice $650k

**DG-767 CUPERTINO:** “Dream Practice” near Apple Headquarters! Real Estate also available. 3 ops 1284 sf $438k

**DN-665 SANTA CRUZ AREA:** Loyal, stable, multi-generational patient base. FFS. 1460sf w/ 4 ops $340k

**DN-693 SAN JOSE Facility:** Attracive & spacious! Faces one of the city’s major thoroughfares. 1080sf w/4 ops $95k

**DN-713 CASTRO VALLEY Lease:** Well maintained, attractive, “Move-In Ready” dental office. 1500sf w/ Sops Call for details! $175k

**DN-767 SANTA CRUZ Area:** The perfect place to sink down roots, raise a family & build an empire! 1100sf w/2 ops + 1 add’l. $50k

**DN-771 SOQUEL Facility:** The perfect place to sink down roots, raise a family & build an empire! 1100sf w/2 ops + 1 add’l. $50k

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EC-729 GREATER SACRAMENTO AREA: Seller retiring! FFS Practice and Real Estate Available!

EG-716 ELK GROVE: Remarkable potential for growth w/ attention to marketing & increased office hours! 1200sf w/ 3 ops $270k

EG-722 ROSEVILLE: On track to collect $1.5M in 2017 with increased profit compared to last year! Price Reduced even though collections are increasing! 1919sf w/ 4 ops $1,050k

EG-744 SACRAMENTO: Well established, highly esteemed Sacramento Practice 1320sf w/ 3 ops $250k

EN-628 ORANGEVALE: Great place to work, play & live. HMO 1310sf w/ 4 ops + 1 add'l $375k

EN-654 CITRUS HEIGHTS: Well established & loaded with 30+ years of goodwill! 1300sf, 3 ops + 2 add'l $150k

EN-660 ROSEVILLE: Highly-esteemed, well-respected, fee-for-service practice w/ loyal patient base. 2950sf w/ 5 ops $995k

EN-664 SACRAMENTO Facility: Great corner location, excellent visibility & easy access! 2300sf w/ 4 ops $550k

EN-702 SACRAMENTO: Long-established practice w/ emphasis on preventative dentistry! 1600sf w/ 4 ops + 1 add'l $450k

EN-708 SACRAMENTO: Family-oriented practice with appreciative & loyal patient base. 1600sf w/ 4 ops + 1 add'l $150k

EN-747 CITRUS HEIGHTS Facility: Be the only dental office in this attractive, popular Retail Shopping Center! 1200sf w/ 5 ops + 6 add'l $150k

EN-749 LINCOLN: Come sink your roots down and enjoy a fantastic lifestyle which can’t be beat! 1877sf w/ 4 ops + 1 add'l $320k

EN-755 FOLSOM: A perfect location, envied by all! Enjoy an amazing quality lifestyle in this thriving city. 1200sf w/ 4 ops. $175k

EN-768 WEST SACRAMENTO: Family-oriented practice, equipped with updated technology! 1612sf w/ 4 ops. $275k

FC-650 FORT BRAGG: Family-oriented practice. 5 ops in 2000sf, 6 npts/mo $350k for the Practice & $400k for the Real Estate

FC-677 FORT BRAGG: Beautiful, FFS Practice, 4 ops + 1 add'l, in 2375sf, Gross $1M+/yr $500k

FN-754 SOUTHERN HUMBOLDT: If you love the lure of sea air, a relaxed lifestyle & charm of coastal living, then look no further! 1500sf w/ 3 ops + 1 add'l. $195k

GC-472 ORLAND: Live & practice in charming small town community. 1000sf w/ 2 ops. Seller Retiring $160k

GG-454 PARADISE: 2550sf w/ 9 ops. 40 yrs goodwill! Amazing Opportunity! $450k

GN-656 NO. TEHAMA CO: Great Location! Ideal place to work, live & raise a family! 2486sf w/ 5 ops Now Only $225k

GN-667 OROVILLE: Great place to work & play! Constant growth attracting an influx of residents! 1000sf w/ 3 ops $195k

GN-668 BUTTE COUNTY: Remodeled in 2010! Well-maintained, long-established professional complex. 1200sf w/ 2 ops $95k

“Ask the Broker” can now be found at www.westernpracticesales.com

NORTHERN CALIFORNIA

GN-717 YUBA CITY: Seller Retiring. All reasonable offers considered. Building available for purchase! 2400sf w/ 5 ops $475k

GN-746 YUBA CITY: State-of-the-Art Equipped! Includes the latest technology in CBCT Imaging. Real Estate also available! 1600sf w/ 3 ops +1 add'l. Practice $480k/ Real Estate TBD.

HG-732 GRASS VALLEY: Seller retiring. Well established practice. 1250sf w/ 3 ops. Real Estate also available. $215k

HN-280 NORTHEAST CA: Only Practice in Town! 900sf w/ 2 ops $60k

HN-618 SIERRA FOOTHILLS: Seller Retiring! Huge opportunity for growth by increasing office hours! 750sf w/ 2 ops $95k

HN-740 SHASTA CO: Warm, caring atmosphere that is magnified by the exceptional, long-term staff. 2400sf w/ 5 ops + 1 add’l $475k

CENTRAL VALLEY

IC-468 SAN JOAQUIN VALLEY: High-end restorative practice! 6 ops in 2500+sf office. Call for Details! $425k

IG-687 TURLOCK: Established quality practice - remarkable opportunity! 2000sf w/ 5 ops $298k

IN-761 MODESTO: Practice philosophy: “Patient First Care” quality care in a warm, comfortable, and yet professional environment. 5,395 SF W/ 12 + 1 add'l. $150k

JG-753 VISALIA: Pedo/GP Practice AND Real Estate Available! Stellar reputation, 30 pts w/ 15 hyg pts daily! Spacious 2600 sf office! Call for Details!

SOUTHERN CALIFORNIA

KC-678 LOMPOC & SANTA MARIA: Live & practice along the central coast. Plenty of room for growth, Call for Details! $240k

SPECIALTY PRACTICES

AC-748 SAN FRANCISCO Perio: Practice in this prestigious building in desirable central location. 3 ops, 980sf $800k

AC-759 SAN FRANCISCO Endo: Union Square. 1190 sf w/3 ops (plumbed for 1 add’l)! $495k

IC-543 CENTRAL VALLEY Ortho: 1650sf w/ 5 chairs in open bay & plumbed for 2 add’l! Strong referrals and PT base $125k

HG-763 GRASS VALLEY Ortho: Avg 30+ pts per day. Newer retail Shopping Center $210k

JG-757 VISALIA Perio: Keep implants in house and imagine the growth possibilities! 9 hygiene days per week! Rare Gem! 2,000 sf w/ 5 ops $395k
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